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AND

ADVOCATE OF INTERNAL IMPROVEMENTS.

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AMERICAN RAILROAD JOURNAL.

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AN APPENDIX

To the Report of the Committee on Railroads, on the petition of the New-York and Erie Railroad Company.

MR. JOHNSON'S REPORT.

To the President and Directors of the New-York and Erie Railroad Company:

GENTLEMEN—In compliance with your wishes, that I should communicate my views upon the character and importance of Railroads, as a means of intercommunication, and also of the merits of the New-York and Erie railroad route, compared with others which have been projected from New-York city to the St. Lawrence and Mississippi Valleys, I present the following statement, drawn up with some haste, and which though in consequence, somewhat imperfect, will be found, it is believed to contain facts and information on this interesting subject not generally understood, and in consequence not duly appreciated.

Railroads, as a means for transportation, have been long in use upon a limited scale; but it is only within the short period of ten or twelve years, that they have been successfully applied to purposes of general traffic.

The great importance which they have so recently acquired, is mainly the result of the successful application of the power of steam to locomotion, and which is found to transcend in economy, speed and useful effect, the most successful application of animal power.

The important part which the locomotive engine has thus performed, in imparting to the railroad system its present degree of perfection, and which may possibly yet give it the ascendancy as a general means of inland communication, will constitute a sufficient excuse for bestowing upon the principles of its construction and operation, a little attention.—In the progressive movement of the engine upon the railroad, the several resistances which it encounters, and which must be overcome by the elastic force or pressure of the steam in the cylinders, consist of the following:

1. The resistance of the engine itself, comprising the friction of the pistons, steam-valves, connecting rods, water-pump, &c. with the power to work the latter; the additional friction caused by the re-action of the load drawn, also the friction of the axles and at the surface of the rails, and resistance of the air, the latter of which is principally encountered by the engine in consequence of its position in advance of the train. To these must be added the atmospheric resistance to the movement of the pistons in the cylinders, which takes place in all engines that do not condense their steam, and the increase in the elastic force or pressure of the steam required by the greater velocity of the engine and its load over that of the pistons.

2. The resistance arising from the friction at the axles, and surface of the rails of the carriages composing the train, and also of the tender to the engine.

The preceding comprise the more prominent of the resistances to the movement of the locomotive engine upon a straight and level railroad.

Upon such portions of the road as are curved, an additional resistance is encountered, which depends for its amount upon the radius or degree of curvature, but which is obviated in a great measure by the superior elevation given to the outside rail of the curve, and the conical shape of the rims of the wheels, and does not constitute any very great impediment upon curves which exceed one thousand feet radius.

Upon roads that are not level, the force of gravity, if the engine is ascending, presents another cause of resistance. In descending, this force operates in aid of the impelling power of the engine.

The force with which gravity operates, whether in aid or to retard the movement of the engine and its load, varies with the inclination of the road, and by the established principles of mechanics, bears the same relation to the weight nearly on the planes of moderate inclination, as the elevation of the plane to its base or horizontal extent.

The above resistances, when accurately determined and resolved into their combined effect upon the pistons in the cylinders of the engine, constitute the true measure of the elastic force or pressure of the steam required to propel the engine and its train.

The amount of this elastic force or pressure is dependent upon various circumstances, all of which have been determined by experiment, and the influence of each separately and combined very nearly ascertained. These consist of the intensity of the heat. The extent of surface in the boiler exposed to the radiant and communicative action of the heat or total extent of effective evaporating surface, involving the expenditure of fuel and water, rate of the expansion of steam in the cylinders, dimensions of the steam pipes, steam valves, water pumps, smoke pipes, &c.

It is only within a little more than three years, that experiments have been made on a sufficiently large scale, to determine the relative value of the several causes which influence the operation of the locomotive steam engine upon railways.

These were performed by the Chev. F. M. G. De Pambour, upon the Liverpool and Manchester railway, with the aid of that company, and the results were arranged and analyzed by him, from which formulæ are deduced for determining the power of traction of engines of different dimensions and plans of construction under various rates of speed and degrees of the pressure of the steam, &c., which, with the exception, perhaps, of a few slight inaccuracies in the mode of conducting and analyzing the experiments, may be relied upon as approaching very near the truth.

From these formulæ may be determined the powers of the improved American engines, under a knowledge of the dimensions of their several parts, and a series of results obtained, adapted to various rates of speed and degrees of acclivity of the road.

These results I have computed for two engines of different weights and dimensions, and arranged in a tabular form as follows:

A PRACTICAL TABLE of the power of traction of Locomotive Engines, exhibiting the gross load in tons, including the tender at different rates of speed, and upon inclinations varying from a level to one hundred feet per mile. Deduced from the formula of De Pambour.

	Weight of engine, 13 tons. Evaporating power, 55 cubic feet. Cylinders, 1.16 feet dia.									Weight of engine, 10 tons. Evaporating power, 42 cubic feet. Cylinders, one foot dia.								
	VELOCITY IN MILES PER HOUR.									VELOCITY IN MILES PER HOUR.								
Ascent in feet per mile.	VIII½	X	XII½	XV	XVII½	XX	XXII½	XXV	XXVII½	VIII½	X	XII½	XV	XVII½	XX	XXII½	XXV	XXVII½
	tons.	tons.	tons.	tons.	tons.	tons	tons.	tons.	tons.	o ns	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
Level.	584	406	299	228	177	138	108	85	66	448	311	230	175	137	108	85	67	52
X	375	251	190	144	111	86	66	51	39	280	201	145	113	87	68	53	41	32
XX	275	183	138	104	79	61	46	35	26	204	145	106	80	61	47	37	28	20
XXX	216	144	108	81	62	46	34	26	18	162	114	82	63	47	36	28	20	14
XL	178	117	87	65	48	36	26	19	13	132	93	67	50	37	28	21	15	10
L	147	97	71	52	39	29	21	15	9	111	77	55	40	30	22	16	11	7
LX	131	85	63	46	34	24	17	12	7	97	68	48	35	26	19	13	9	
LXX	112	73	53	38	28	20	13	9		84	57	41	29	21	15	11	7	
LXXX	102	65	47	34	24	17	12	7		75	52	36	25	19	13	9		
XC	90	58	42	29	21	14	9			67	46	32	23	16	11	7		
C	81	52	36	27	18	12				61	42	29	21	14	9	6		

Total pressure of steam upon the square inch in the boiler, 70 lbs.; dia. of driving wheels 4. 5 feet; length of stroke in feet, 1.33; friction of engine, 14 lbs. per ton; friction of carriages, plus, additional friction upon engine from load drawn, 8 lbs. per ton; the ton employed equals 2,000 lbs; the wheels of the engine are supposed to be coupled, if necessary, when drawing the maximum loads, or otherwise so arranged as to bring the weight of the tender upon the driving wheels.

The decrease of the load under an increase of velocity, as indicated in the table, is not so much the consequence of any great increase of the resistance, as of the diminished power of the engine, or its inability to generate steam to correspond with the increased consumption under a greater velocity.

By augmenting the intensity of the heat, the force of traction under an increase of velocity will be increased. It is a consequence of the particular construction of the locomotive steam engine, by which the steam from the cylinders is discharged into the smoke-pipe, that an increase of draught, and consequent augmentation of the intensity of the heat, is produced to a certain extent, by a greater velocity; and it is from this cause that the powers of the engine are so well sustained under the higher velocities.

It is the rapid generation of steam, occurring under the higher velocities which usually takes place upon the more level portions of a road, that causes the blowing or escape of steam at the valves, whenever the motion of the engine, and consequently the consumption of steam is checked by encountering grades of greater acclivities. In such cases, the fire being greatly excited, the pressure in the boiler is augmented, and continues in this state until the steam generated, no longer exceeds the consumption.

It is from this cause that the performances of the locomotive engines, upon short ascents, *are known to exceed very considerably* the results given in the table.

It will be noticed by a comparison of results in the table, that a great similarity exists in the general law which governs the operation of steam and animal power. There is a speed at which the locomotive, like the horse, can do no more than convey its own weight. This limit does not however depend as in the case of the horse upon any inherent power of action which cannot be exceeded, but is governed mainly by the size of the boiler, and evaporating power and weight of the engine.

It will be seen also, that the loads drawn increase in a greater ratio than the decrease in the velocity, and that so far as it regards the conveyance of the greatest weight over a given distance in a given time, on roads having a uniform grade, the advantage is greatly in favor of a diminished rate of speed. A saving also in the wear and tear and cost of traction is usually the result under such a diminution.

This range of the power of the locomotive engine, under differtent rates of speed, is of the greatest importance in reference to economy of transportation, combined with the cost of construction of railroads, enabling it, without a sacrifice of power, to overcome considerable variations in the grades; which are necessary to conform the road to the shape of the ground, and which would require in many cases an immense expenditure to reduce to a level, or to an uniform inclination.

An examination of the table will show, that the load which an engine can convey at the rate of twenty-five miles per hour upon a level, can be drawn by the same engine up an inclination of 90 feet per mile at 7½ miles per hour; also, that the load on a level at 20 miles per hour, is equal to that on an ascent of 52 feet per mile, at 7½ miles per hour, and that the load on a level at 15 miles per hour is equal to that on an ascent of about 27 feet per mile, at 7½ miles per hour.

It must not be forgotten, that the adhesion of the driving-wheels of the engine to the rails, is supposed sufficient in each case to enable the engine to exert its whole power in propelling its load.

In consequence of this great range of power of the locomotive engine under different velocities, loads adapted to the full capacity of the engine upon the level or less elevated parts of a road, at the higher or medium rates of speed, can be conveyed over the more elevated portions, occasioning no other inconvenience than arises from a loss of time by the reduced speed in ascending acclivities. Thus the same load which would be conveyed at the rate of 20 miles per hour on a level, can be moved only at the rate of 15 miles per hour on a continued acclivity of 12 feet in a mile, or at the rate of 10 miles per hour on an acclivity a little exceeding 30 feet per mile, or 7½ miles per hour an ascent of 50 feet per mile.

The ability of the locomotive engines to convey heavy loads with the velocities above mentioned, is fully demonstrated by experience.

In the report of the superintendent of motive power of the Philadelphia and Columbia railroad for the year ending Nov. 30th, 1837, it is stated that "*one of the heavy engines drew 35 cars, constituting a gross load of 190 tons, on a road with grades running up to 50 feet per mile;*" and that the average rate of speed in performing the distance of 82 miles, was 10 to 12 miles per hour. The Canal Commissioners of Pennsylvania, in their last report to the Legislature, speak in decided terms of "the approximation to perfection, which the construction of locomotive engines, and the economy and system in their use, has reached;" and add, in confirmation of the preceding, that "as an instance of extraordinary performance, some of the engines have drawn a gross weight of 190 tons over the Phila-

delphia and Columbia road, within the usual time for performing a trip."

Other instances may be adduced of equal or greater performances, but as this is derived from an official statement made to the Legislature of Pennsylvania, on the condition of one of the most prominent roads in the country, and which is now doing a constant and profitable business in the conveyance of freight and passengers, I have concluded that any further evidence would not be necessary.

In addition to those improvements which have conferred greater powers upon the locomotive engine, others have been made, by which the expense of operating is materially lessened.

In 1834, the average cost of the repairs and renewal of engines upon the Liverpool and Manchester railroad amounted to nearly $3,000 each per annum. This item, being a prominent one in the expense of locomotive power, has been considerably reduced by improvements in the proportions and connexion of the different parts of the engine, giving it greater strength and ability to resist the strains and injuries to which it is subjected. Their management is also better understood. Upon the Philadelphia and Columbia road, the cost for the past year has fallen considerably below $800 for each engine. As an instance of remarkable performance on this road, it is stated in the report of the Canal Commissioners already referred to, "*that one engine made 175 successive trips of 77 miles each, with the regularity of the return of day, making a total of thirteen thousand one hundred and seventy-five miles, without a dollar's worth of repairs.*" The diminished cost upon the latter road, compared with the former, is owing in part, in addition to the circumstances mentioned, to the less average rate of speed, which is only about three-fourths that upon the Liverpool and Manchester road at the time mentioned.

In respect to the resistances presented fr the movement of an engine, arising toom the shape or particular arrangement of the road itself, it is believed much misapprehension exists, particularly in reference to vertical changes in the aliguments or in the ascents or descents necessary to be overcome.

The principal difference between level or uniformly inclined, and ascending and descending lines, is in the influence of gravity produced by these changes. The resistance at the surface of the rails is the same. That arising from curvature is the same, the ascents and descents not necessarily involving any increase in curvature. The resistance from the atmosphere is also the same, and that presented by the friction at the axles is nearly the same, if any difference, it is less.

In respect to gravity, this power is a resistance only in ascending. In descending, it acts with a similar energy in *favor* as in ascending it operates *against* the movement of the engine and its train. If a balance be struck between the sum total of the aiding and retarting effects of this power, on a road having an irregular profile, it is found to be nearly the same under all practicable variations of the grades, whether the irregularities are diminished or increased.

This is the theoretical view—practically the aid derived from gravity cannot in the great majority of cases be applied to neutralize, or be used in offset to its resistance.

In descending, no practical benefit is derived from it beyond that point where the inclination of the road is such as to enable it to overcome the friction, and other resistances encountered by the engine and its train, and impart to the latter the velocity which is consistent with safety. Beyond this, the motion upon long slopes, when the rails are in good condition, becomes too great for safety, and must be counteracted. The full benefit of the aid afforded by gravity in descending, is likewise not experienced, if the length of time occupied in the descent is such, as either to cause an escape of surplus steam or render impracticable a reduction of the heat, so that no more steam may be generated than can be profitably passed through the cylinders.

Again, if the ascents or deviations from a level or an uniform inclination require to overcome them, a greater range of power than is possessed by the engine by varying its velocity, or a greater degree of adhesion than is afforded by the driving wheels, a loss is incurred, either by the necessary diminution of the load to enable it to overcome the greatest acclivities, or auxiliary power must be employed at an additional expense for that purpose. If the steeper grades are concentrated, and their length and degree of acclivity such as to give full and profitable employment to the auxiliary power, the disadvantage in the economy of traction is much less than it would be under a different arrangement, when those grades are detached and distributed irregularly upon different portions of the road.

Although inequalities in the grades are, as a general rule, to be avoided, if possible, yet, to a certain extent, they are not very objectionable. To suppose a very favorable case—a case, which it must be acknowledged, is scarcely likely to occur in practice—it can be demonstrated, that it is possible, under a *suitable arrangement of the grades* of a railroad, to convey by locomotive steam power a load, over a straight road, having a rise and fall of 20 to 25 feet per mile throughout its whole extent, in nearly the same time, and at an expense no greater than the same load can be conveyed by the same engine, over the same road, reduced to a level.

It may be remarked farther, that the influence of ascending and descending grades upon the economy of transportation, is subject to modifications, arising from the preponderance or difference in the relative amount of trade passing in opposite directions. In cases where this preponderance is great, the cost of transportation will be lessened or increased according as the arrangement or position of the steeper grades is favorable or unfortunate to that preponderance. The *total* cost of transportation upon railways is also affected by the greater or less expense incurred, or amount of fixed capital invested for the purpose of equalizing or reducing the grades in the construction of the road. This involves the consideration of the value of labor and materials, quality, amount and cost of excavation and embankment, mechanical work, and other expences necessarily incurred in the several positions which the grade line may be permitted to assume upon the ground; also the difference in the distance involving the cost of additional extent of superstructure upon the long lines, repairs and maintenance of the same, and extra wear and tear of engines, carriages, &c.

The location of a railroad is usually a more difficult operation, requiring more calculation and more extensive examinations and measurements than the location of a canal. In tracing a route for the latter, little or no deviation from a level line is called for, or can be permitted, except at suitable places for inserting locks, or inclined planes, where the transition is made from one level to another. The horizontal changes in direction or curvatures upon a canal do not, moreover, require to be traced with any great degree of accuracy, the line in this respect being allowed usually to conform nearly to the particular shape of the ground. Upon railroads, the grades may be permitted to assume, according as local and other circumstances may require, every variety of position, varying from a level to that degree of inclination either ascending or descending, which is the measure of the useful effect of the locomotive engine, whether operating alone or aided in its efforts by auxiliary power. Such is the character of railways also, that the straight and curved portions must be arranged so as to harmonize completely with each other, presenting no abrupt changes in the continuity of the line, and requiring in consequence, that the curves be traced with the greatest practicable degree of precision.

I mention these circumstances, to show how much the efficiency of railroads, and consequent cost of transportation upon them, depends upon the particular arrangement of the grades and other causes, and to show how important it is, in estimating the expense of transportation, that all the attending circumstances should be duly considered; and also how essential it is in the location of railroads, that the principles of their operation should be scientifically and practically understood and applied, since any error or defect in this respect, which shall

lessen the efficiency of the road or the economy of transportation upon it, is in most cases irremediable, except at great expense, extending its injurious influence through all future operations of the road.

I allude to these circumstances, also, to show that any effort to establish a definite or fixed ratio between a given vertical rise or fall and its equivalent horizontal distance, in reference to economy of transportation, is futile, so far as railroads are concerned. In regard to canals, a much nearer approximation can be made to a fixed standard in this respect, it being usually assumed that about 25 feet vertical rise or fall is equivalent to one mile horizontal distance, upon the supposition that the cost of locks for transferring boats from one level to another is about equal to three miles in length of canal; and the delay and expense in passing, about equal to the time and expense in traversing the mile of canal; thus rendering the one nearly equivalent to the other. Upon railways the circumstances are so entirely different, that no fixed rule, applicable in all cases, can be established.

The character of railways, and the general principles of their operation having been, it is believed, sufficiently explained, I will next proceed to make some remarks in relation to their capacity for conveying passengers and the various articles of commerce, and the cost of transportation.

The Philadelphia and Columbia railroad, to which I have already alluded, is the property of the Commonwealth of Pennsylvania. It extends from Philadelphia to the Susquehannah river, a distance of 82 miles, and is part of the main line of State improvements reaching to Pittsburgh. Its highest grade, as already stated, is 50 feet per mile, for a short distance, and there is a continuous slope of 9 miles in succession, at the rate of 30 feet per mile.

The loads drawn by the locomotives are of necessity graduated to the lowest velocity admissable upon the maximum grade, and do not exceed, probably, the one-half or one-third part of what could be conveyed upon a level. Indeed, the superintendent, in his report, states, with perhaps too much confidence, that, "if the Warren grade should be dispensed with, by the avoidance of the Schuylkill plane, and the Gap grade reduced, there would be *no limit* in practice to the loads that could be hauled."

The Philadelphia and Columbia railroad was constructed at a cost of $3,330, 127. The superstructure for both tracks is laid throughout, and is composed principally of rails of iron laid upon a stone and timber foundation. There are two inclined planes upon it, operated with stationary steam power, situated near the extremities of the road, one of which is soon to be dispensed with, at an estimated animal saving of $17,400.

In conducting the transportation upon this road, the State furnishes the motive power only, and consequently has nothing to do with the business of purchasing and maintaining carriages, receiving and distributing freight, &c. This latter is performed by individuals or companies, who associate for the purpose. The report to which I have alluded, states that the total charge for *rail-way* and *motive power* tolls received of each passenger travelling the whole length of the road, or 82 miles, is $1.74, equal to $2\frac{1}{8}$ cents per mile; and that the average total charge per ton for freight is $3, equal to about $3\frac{2}{3}$ per mile.

With these charges, it is stated that the road has defrayed all expenses of motive power and repairs, together with the interest upon the cost of construction; and this notwithstanding much unnecessary expense was incurred in preparing for a considerable increase of business, which was not reallzed, owing to the change in the times, the force not having been brought down to an equality with the trade until as late as the first of July.

The whole cost per ton per mile of transporting freight upon the road the past year, exclusive of profit or tolls, is not stated in the report.

The charge for motive power only, per ton per mile, is 12 mills, which probably includes some profit, for, "after defraying all expenses of this department, it has paid the interest at 7 per cent. on the original cost of all the locomotives, ($326,103.41) 50 in number, that have been put upon the road." It will not, it is believed, be placing it too low to consider the whole expense of transportation, exclusive of railway tolls and profit, at 2. 2 cents per ton per mile.

Independent of any prospective improvements in the application of steam or other power upon railroads, the increase of business, from the growing trade and increasing population of the country, will produce in a short time, a material reduction in the costs of transportation.

Should the business be doubled, the expense upon the Philadelphia and Columbia railroad would probably not exceed $1\frac{1}{2}$ cents per ton per mile, particularly if we take into consideration the saving to be made by dispensing with the inclined plains. This, upon a railroad with grades and curvatures as unfavorable as that of the Columbia, would probably be still farther considerably reduced upon a level railroad of the same extent.

Results similar to the preceding are derived from the experience upon the Baltimore and Ohio road, showing that the cost of transporting freight upon roads of 70 to 80 miles in length, with ordinary grades, and doing a full business, will not probably exceed $1\frac{1}{3}$ cents per ton per mile, at a velocity of 10 to 12 miles per hour, being a speed four to five times greater than is attainable upon a canal where boats are moved by animal power.

The superiority which railroads possess, as a medium for the transit of passengers, gives them great advantages in the transportation of freight. Upon a road doing a large passenger business, sufficient to maintain itself and pay the interest on its cost, freight may be carried, if necessary, in the event of competition, at an expense, without loss, not exceeding the actual cost of transportation, independent of profit or tolls; or, if the conclusions above stated are correct, at a total cost to the merchant or farmer, not exceeding $1\frac{1}{3}$ cents por ton per mile.

This is an important view of the subject, and will have a great bearing upon the future importance and success of the railroad system.

In a report presented to the Legislature of New York, in March, 1835, by engineers in the service of the State, it is stated, p. 27, that the "actual cost of transportation upon the Mohawk and Hudson railroad, for freight, exclusive of profit or toll, is $3\frac{1}{2}$ cents per ton per mile, and for passengers $1\frac{7}{10}$ cents each per mile;" and the conclusion, p. 33, is drawn that "experience thus far has settled the cost at $3\frac{1}{2}$ cents per ton per mile for freight upon a level road."

The Mohawk and Hudson railroad is $15\frac{7}{8}$ miles in length, and has a total rise and fall of 439 feet, overcome in part by two inclined planes with stationary engines situated near the extremities of the road. The peculiar arrangement of this road required the use of three kinds of power, viz: the horse-power, stationary steam-power and locomotive steam-power. The maintenance of these several descriptions of motive power upon so short a road, and the inferior character of the locomotives employed, necessarily enhanced very much the expense. The same number of agents, superintendents, &c. and the same amount of capital invested in engines, carriages, &c. would probably have sufficed for a much longer road, and for the transportation of a much larger quantity of freight, which, at the time, from particular causes, was limited in amount.

The cost of transportation upon the Mohawk and Hudson railroad was, therefore, no evidence of what could have been accomplished on extended lines of railway, properly located, at the time the report alluded to was written, and consequently is no indication of what can now be accomplished upon similar lines, under the great improvements which have since taken place.

The following is a statement of the power of traction of locomotive engines upon different inclinations of road, as exhibited in the report referred to, p. 33:

Ascent in feet per mile.	Gross load exclusive of tender—tons, (2,000 lbs.)	Cost of motive power per ton per mile—cents.
Level.	75.25	3.50
10	49.53	4.20
20	37.35	4.90
30	27.24	5.95
40	20.22	7.28
50	17.04	8.19
60	13.92	9.66
70	11.31	11.41

"Weight of engine 6½ tons (13,000 lbs.); 7,000 lbs. on *working* wheels; adhesion at 10; weight of tender, 7,000 lbs; resistance from friction 2½. The load carried is exclusive of the tender, and includes freight and waggons." Velocity not stated.

I will not stop to compare the above results with what is now accomplished. The contrast is very great, as will be obvious from what has already been stated.

In respect to the useful and profitable adaptation of well constructed railroads to the conveyance of various descriptions of freight, there is now no doubt. On their first introduction, they were in general expressly designed for the conveyance of heavy commodities, such as coal, stone, &c., and since they have been used for purposes of general traffic, experience has shown that they are exceedingly well adapted to this object.

Upon most of the railroads in operation in the United States, freight of all descriptions is now carried, embracing merchandize, cotton, flour, and produce of every description, including live stock, lumber, mineral coal, &c. Upon the Baltimore and Ohio road, in addition to the usual varieties of freight, yards and spars, and other timber are conveyed.—Upon the Philadelphia and Columbia railroad, notwithstanding there is a navigation connecting the waters of the Schuylkill at Philadelphia, with the Susquehannah, by means of the Union and Schuylkill canals, large amounts of lumber and of heavy and bulky articles of various descriptions are transported. Indeed, the superintendent of the latter road, in a late report, states that "though the passenger department is that in which the greatest number of citizens are directly interested, and to which, on account of the number of lives risked, the officers of the road are bound to pay the first and most strict attention; yet the transportation of goods and produce is the chief source of revenue to the State."

Upon the Boston and Worcester railroad, the conveyance of freight constitutes a prominent part of the business of the road. The receipts from freight upon this road for the year which has just passed, equal in amount about two-thirds of the gross receipts from passengers. The increase in the former over the preceding year is 30 per cent, while the latter has advanced only 1½ per cent; showing that the transportation of freight is a growing and important part of the business of that road.

The capacity of a well constructed and well managed railroad for the transit of passengers, merchandize, produce, &c. is very great. With a double track complete, and trains of carriages upon each moving in opposite directions, at the rate of ten to twelve miles per hour, continued throughout the year, with trains arriving and departing hourly or half hourly, which is possible under a systematic arrangement, provided the business is sufficiently extensive to require it, and the whole amount will exceed what may be required upon any of the leading thoroughfares of the country for many years to come.

The additional expense of accommodating an increased amount of business upon a railroad, is confined principally to the transportation department, and not to the maintenance of way, the durability of which is affected, mainly by exposure to frosts, floods, and to natural decay, rather than by the severity of the service to which it may be subjected.

That railroads can be successfully used throughout the year in temperate latitudes, with little or no interruption, is now satisfactorily determined. An estimate derived from the experience upon several roads in the northern states, shows an average interruption through the year caused by obstructions from snow, of only two days.

The business upon the Philadelphia and Columbia railroad was interrupted but three days the past year, viz. the 22d, 23d and 24th of January, at which time there occurred an unusually severe snow storm. According to the report of the superintendent of motive power, "many of the deep cuts were wholly filled up, and the road was generally covered with three feet of snow; yet with the combined force of only three locomotive engines it was cleared off, and the road in use in the time stated."

Upon the Utica and Schenectady railroad, little or no interruption has been experienced from this cause since the road went into operation. The snow in the latitude of New-York does not fall on an average more than about 20 to 25 days in the year; and upon a road doing a constant business, is in most cases removed before it accumulates so as to offer much resistance. The interruption arising from this cause to railroads doing a regular business with a locomotive steam power, cannot be said to exceed the ordinary interruptions to the transportation upon canals from breaches in the banks, repairs and floods, and other failures during the season of navigation.

In severe cold weather, the efficiency of the engine is sometimes lessened by the effect of the cold, in reducing the temperature and diminishing the elasticity of the steam. The adhesion of the driving wheels of the engine is also sometimes considerably impaired by frost and ice upon the rails, rendering the engine incapable of applying its full power to the propulsion of its load. The inconvenience experienced from these causes is however much lessened from the circumstance that the natural diminution of the business in the winter does not demand at that season so great an expenditure of power.

It is true, that the cost of traction per ton or per passenger will be somewhat enhanced; yet if conducted with less profit or advantage to the company, the public are benefited by the great accommodation which good winter communications must ever afford.

In addition to the advantages possessed by rail-roads over canals, in being available at all seasons, there are others when viewed as a general means of intercommunication, to which it may not be improper in this place to allude.

They can be made to traverse the more elevated sections of the country, for the accommodation of mines, villages, &c. where canals would be impracticable, or if practicable, could only be constructed at great expense.

Branch rail-ways, connecting with a main line for local accommodation, can be constructed with greater facility, and at an expense generally less, than branch canals for effecting the same object.

The average attainable speed upon rail-ways is from four to six times greater than is practicable upon canals, the latter supplying very imperfectly the wants of the public, for the purposes of travel, and the conveyance of the mails, while rail-ways are alike adapted to freight or passage.

The great superiority of steam over animal power, in respect to economy, gives to rail-roads a corresponding advantage over canals of small dimensions, where steam cannot be used. The former are being constantly benefited by improvements in the economy and efficiency of the power in use upon them, which cannot be anticipated from the power at present employed upon canals. On the contrary, there is reason to believe, that as the country advances in population, the expense of animal power will in consequence be rather increased than diminished.

In reference to the general defence or military strength of the country, railways present great advantages in affording the means of a rapid concentration of forces at particular points, and are not as readily destroyed or rendered useless by the incursions and assaults of an enemy. They contribute, in the rapidity of their transit and availability at all seasons, to the suppression of monopolies in trade, the rapid diffusion of intelligence, the increase in the population and wealth of the country, and in the general economy and comforts of living. They in fine, may perhaps be said to promote in a higher degree the great benefits resulting from common and turnpike roads and canals, the advantages of which have with great justice been ranked next in importance to the genial influences of the seasons.

In a review of the project for the New-York and Erie Railroad, written nearly ten years since, I had occasion to point out, as I have done above, some of the prominent points of difference between railroads and canals, and I then ventured the opinion that railways possess properties which in most situations would render them more desirable than canals. Subsequent experience has contributed to confirm the correctness of the views then entertained and expressed. The whole extent of railways at present in

progress or contemplated in the United States, is treble or quadruple that of canals.

The peculiar advantages derived from the railroad system in its accommodation to the travel and business of a country, is strikingly exemplified in what is now taking place in England, where notwithstanding there are few places of importance farther removed from navigation of some kind, either natural or artificial, than twelve to fifteen miles, and notwithstanding the advantages possessed by that country in the great perfection of its public roads, lines of railway are being constructed and extended in various directions throughout the island, and with abundant promise of benefit, both to the stockholders and the public.

As an illustration of the practical advantages of the railroad system, I will instance the case of the Utica and Schenectady railroad.

The number of passengers carried upon this road has thus far been equivalent to about 105,000, passing over the whole road annually. The charges being $3 for each passenger, the total annual receipts amount to $315 000.

The charges for conveying the same number of passengers in stage coaches between the same points, at 4¼ cents each per mile, for 80 miles, amounts to,	$378,000
The time occupied in passing between the two places in stage coaches at the average rate for all seasons, of 5 miles per hour, including stoppages, is 16 hours. Upon the railway it is 5 hours; making a saving in time by the railway to each passenger of 11 hours. Estimating the average value of this time to each passenger at $1,50, and it amounts to,	157,500
Add for extra expense of meals saved to each passenger by the reduction in the time, say 25 cents,	26,250
Making a total of	$561,750
From which deduct the expense per railway as above, leaves,	$246,750

Showing an annual saving to the travelling public by the railway, compared with stage-coaches, of $246,750 This is the saving in time and expense on account of locomotion only to the individuals using the road, and does not therefore include the great advantages of the road in enhancing the value of property, and its beneficial influences in a commercial point of view, upon the business interests of the country generally.

(To be completed in the next.)

We extract from the American Railroad Journal a communication from a correspondent, with the prefatory remarks of the editor. We do so for two reasons; first, to correct an error into which it seems we fell a few weeks since in stating that the Directors of the Liverpool and Manchester Railroad had determined to discontinue the carriage of freight; a circumstance which was stated 'without book' and upon the information of an intelligent friend, who learned it, directly, or indirectly, from a source that even the suspicious VERITAS of the Railroad Journal would not incline to suspect; and next to repel the impeachment of the motives of those by whom the correspondent of the Journal fancies we are surrounded.

While we claim without any scruple on the point of delicacy, all that VERITAS allows to the 'editor of the Observer' for sincerity of purpose, we disclaim with all modesty the less flattering insinuation that we are weak enough to be deluded, without knowing it, into the schemes of those who seek covertly, as intimated by VERITAS, to favor their own interests at the expense of others. The paragraph which has called forth his criticism, was penned upon our own mere motion; and the fact which is deemed of so much importance, if uncorrected, as to stand in the way of his favorite project, was inserted in it some time after it came to our knowledge, which was casually and probably without a thought of its being summoned as evidence of a monstrous design to embarrass and obstruct the New York and Erie Railroad.

Whether the directors and stockholders of the several railroads along the line of the Erie Canal are desirous on their own acconnt to be privileged to carry freight, or not; that the business men of the interior, of all classes, desire it, is, we believe, past a doubt. It was in their behalf—in behalf of the public convenience, during the season of suspended navigation, and in truth at all seasons—that we ventured to call attention to the subject; and in so doing, we assure VERITAS, that the New York and Erie Railroad was not thought of as a rival to any existing improvement, or as likely to be unfavorably affected by the change of policy suggested.

'VERITAS' admits the propriety of the change; but not without qualification as to time, which savors very strongly of those interested and selfish motives which, when they are presumed to govern other men's conduct, appear so heinous in his eyes. Does he intend to convey the idea that the change referred to will be designedly delayed to favor the N. Y. and Erie Railroad; and if so, does he speak by authority of those who are particularly interested in that great plan of improvement? If he does, he is very likely to excite hostility to it in quarters where it does not at present really exist.

We regret to observe a spirit of rivalry in regard to actual or projected improvements, promoting those who are interested in them to charge to corrupt motives and sinister influence every suggestion which may be made through the press or otherwise, upon points in which the whole public have a concern. When we pen a paragraph without special consultation or advisement, we cannot readily believe that we are imposed on, although we may chance to be mistaken both in fact and opinion? And when we think it prudent or reasonable to consult others, we shall always endeavor to consult those whose sincerity and disinterestedness cannot be impeached. Hostility to the N. Y. and Erie Road is not we believe a common sentiment here; and we doubt if the paragraph which has given rise to so much animadversion was ever considered as having the remotest reference to that improvement, except by the easily alarmed and suspecting VERITAS.—*Utica Observer.*

METAMORPHOSES OF THE MUSQUITO.

The musquito, (says Mr. Gilchrist, surgeon) has three stages of existence, in two of which it is a water insect; in the third, the well-known winged one.

I observed several musquitos on the surface of some stagnant water, each in close proximity to a yellowish substance, which, when viewed through the microscope, proved to be a collection of eggs which the musquitos were depositing; each collection, though not consisting of fewer than 100 eggs, did not exceed 3-20ths of an inch in length, and 1-20th in breadth. The eggs were arranged in lines standing on end, and were each 1-40th of an inch long.

A few of those collections of ova were placed, with some of the water on which they floated, into a tumbler, and placed under a glass shade. In two days and a half the water was found to swarm with animalcules, the shells of the ova were still adherent, as when first observed on examining one minutely, the larger or under end was found to have opened like a lid, to allow the insect to escape into the water.

The body of the newly hatched insect is semi-transparent. In the thorax the heart is seen furnished with four projections; from this organ two blood vessels proceeded down the centre of the body to the end of the tail, which is to be always seen just above the surface of the water, the animalcule having its head downwards.

Between the heart and the elongated tail an active circulation is to be observed, indicating probably that the latter constitutes the lungs or gills, it being always above the surface of the water.

Its motion is quick, and it always goes tail foremost; when in search of food it throws out a couple of brush-like tentacula, which move circularly, and create a vortex, by which the food is attracted within the reach of the depredator. The food appears to be principally decomposing vegetable matter. They occasionally devour their own kind, and their recently quitted shells, &c.

At the termination of 21 days, during which the water was thrice changed, they had attained to three or four twentieths of an inch in diameter. On attaining this age they underwent a second metamorphosis. The shape is materially altered, but the greatest change is that which regards the seat of the gills.—These organs are now situated in the thorax, their former site, the tail being absorbed; and the channel of communication between them and the air consists in two small tubes attached to the upper part of the thorax. In this stage of existence the insects are much less active than in their former state. They do not require food, and have no mouth, resembling in this respect the chrysalis of the butterfly. They seldom leave the surface, and when they do so, speedily return to it.

The insects remain in this stage about 48 hours, towards the termination of which the legs and proboscis of the winged musquito can be plainly seen through the thin membrane that surrounds it. This in due course bursts, when the musquito draws itself out, stands on the surface of the water a few minutes, to dry and expand its wings, then flies to a dry situation.

If the musquito, in either of the two first stages, be then taken out of the water, it speedily dies, and it is as quickly killed by immersing in that fluid after becoming the winged insect.

We learn from the above details that the musquito is a most prolific insect, and that, as stagnant water is necessary to its propagation, all such ought to be kept as distant as possible from our dwellings. —*Madras Journal of Literature.*

PROSPECTS OF CHICAGO.

The boats that leave Buffalo for Chicago start with from 200 to 800 passengers, which they distribute throughout the Lakes. The price of passage from Buffalo to Chicago, in the cabin and found, is $25; deck passengers half price. The price of freight on board schooners is $1 per bbl bulk; on board steamboat it is $1 50.

The amount of various kinds of merchandise transported from the East, principally from the city of New York, may be estimated as follows for 1836:—Amount sold in Chicago say $1,000,000—destined for the interior an equal amount.

Chicago will be connected with the waters of the Mississipppi by the Illinois and Michigan canal, now being constructed. The length of the canal is about 100 miles, 60 feet wide at top and 6 feet deep. Its estimated cost is $7,000,000. This canal is a State work, and will be vigorously prosecuted. The U. S. have appropriated every alternate section of land for 5 miles, on each side of it, to aid in its construction. Its terminating points are Chicago, and Peru on the Illinois river. It will be supplied with water from Lake Michigan.

A large number of laborers are now and will continue to be wanted on the line of the Illinois and Michigan canal. $20 per month with board is the price which has generally been paid during the past summer, a portion of the time $26 per month was paid. Mechanics' wages are now about $2 per day at Chicago. Last year they obtained much higher prices. Labor of all kinds has always been in brisk demand.

The steamboat Michigan cost $69,000—her gross receipts in 1836 were $75,000. The nett profit declared on her stock for that year was 50 per cent.—Her receipts for one trip from Buffalo to Chicago and back were $14,500. All the well managed vessels and steamboats on the Lake where no serious accident occurred are supposed to have paid an average profit of 50 per cent. on their cost in 1836.

Up to the spring of 1833 Chicago was simply an Indian trading post, occasionally protected with a small garrison of United States troops. At that time an appropriation was made for a harbor at the mouth of the Chicago river. This gave the first impulse to the growth of the place. It then contained about 300 inhabitants: last autumn it numbered about 5000.

The commanding advantages which Chicago possesses as a commercial position arise from the fact that it stands at the head of the great chain of American Lakes, at a point from which a water communication can be made with the waters of the Mississippi with comparatively little artificial navigation.—*Balt. American.*

GERMAN RAILROADS.

The great conception relative to the establishment of a great continental line of Railroads across North Germany is in progress of execution. The line of Railroads in Belgium extend to the frontiers of France and Prussia, from Ghent to Aix-la-Chapelle. France is hesitating; but Prussia is opening 20 German miles of Railroad, which will afterwards be extended to her capital. The company of Railroads of the Rhine and the Wester have obtained the concession, and are setting to work upon it. Doubts and obstacles disappear. It was said, indeed, that in Germany the expense of Railroads would be enormous and the profits small. And the expense of 233,000 thalers per mile extended on the Belgian Railroad was cited, with the trifling profit of 13 per cent. But these were easily answered. In Belgium they counted only on 70,000 passengers, yet they were obliged to make a second line to accommodate the increased number. In North Germany, too, the country is much flatter, and the cost per German mile will not exceed one-half of the expense in Belgium.—*Minturn Cour.*

☞ Volume Six will be completed as speedily as possible. The next, or Volume for 1838, will be published in a more convenient form for preservation.

*** Subscribers who desire to be supplied with missing numbers, will do well to apply for them soon. We shall always take pleasure in furnishing them if we have them to spare.

☞ Particular attention will be given to the procuring of all kinds of Instruments required by Engineers.—Orders must be accompanied with the necessary funds or city acceptances.

AGENCY.

The Subscriber offers his services as Agent, to procure *Machinery for Mills, Steam Engines, Locomotives, Printing Machines, Presses, Types and Fixtures.*

He will give prompt attention to all orders entrusted to him for execution; and pledges himself to those who may employ him, that no effort on his part shall be wanting to procure the best articles to be had in the city—and to give satisfaction.

He will also employ Millwrights and Engineers, to erect Mills, and put the Engines and Machinery in operation.

Orders accompanied with the necessary funds, or satisfactory city acceptances, should be addressed to D. K. MINOR, 30 Wall-st. N.Y.

LOUISVILLE, CINCINNATTI, AND CHARLESTON RAILROAD.

NOTICE TO CONTRACTORS.—Sealed Proposals will be received at the Office of the Company in Columbia, S. C., until the 15th day of February next, for the graduation and masonry of that portion of the Road from Columbia to the crossing of the Congaree River, in the vicinity of McCord's Ferry, being 25 miles in extent.

Also, for the construction of a Bridge of 400 feet in length, on the Congaree River, to be built on stone piers and abutments, for which there are suitable quarries in the neighborhood.

The plans and profiles of the line will be ready for inspection at the Office of the Resident Engineer, in Columbia, S. C., after the 10th day of February.

So soon as the surveys for location, now in progress, are completed, that part of the Road extending from McCord's Ferry to the Charleston and Hamburg Railroad, at Branchville, will be put under contract, of which due notice will be given.

WM. GIBBS Mc NEILL,
Chief Engineer.

☞ The Railroad Journal, N. Y. Courier & Enquirer, N. York; Providence Journal, Providence, R. I.: Atlas, Boston; Philadelpia Enquirer, Philadelphia; will publish the above notice 6 times, send a copy of the paper to the Office in Charleston, S. C., and a certified copy of their account for payment

Jan. 12 fmw6

NEW ARRANGEMENT.

ROPES FOR INCLINED PLANES OF RAILROADS.

WE the subscribers have formed a co partnership under the style and firm of Folger & Coleman, for the manufacturing and selling of Ropes for inclined planes of railroads, and for other uses, offer to supply ropes for inclined planes, of any length required without splice, at short notice, the manufacturing of cordage, heretofore carried on by S. S. Durfee & Co., will be done by the new firm, the same superintendent and machinery are employed by the new firm that were employed by S. S. Durfee & Co. All orders will be properly attended to, and ropes will be shipped to any port in the United States.

12th month. 12th, 1836. Hudson, Columbia County, State of New-York.

ROBT. C. FOLGER.
33—tf GEORGE COLEMAN.

AMES' CELEBRATED SHOVELS, SPADES, &c.

300 dozens Ames' superior back-strap shovels.
150 do. do. do. plain do.
150 do. do. do. cast steel Shovels & Spades
150 do. do. Gold-mining Shovels
00 do. do. plated Spades.
50 do. do. socket Shovels and Spades

Together with Pick Axes, Churn Drills, and Crow Bars (steel pointed), manufactured from Salisbury refined iron—for sale by the manufacturing agents,

WITHERELL, AMES & CO.
No. 2 Liberty street, New-York.
BACKUS, AMES & CC.
Fo. 8 State-street, Albany.

N. B.—Also furnished to order, Shapes of every description, made from Salisbury refined Iron. v4-tf

MACHINE WORKS OF ROGERS, KETCHUM AND GROSVENOR, Paterson, New-Jersey.

The undersigned receive orders for the following articles, manufactured by them, of the most superior description in every particular. Their works being extensive, and the number of hands employed being large, they are enabled to execute both large and small orders with promptness and dispatch.

RAILROAD WORK.

Locomotive Steam-Engines and Tenders; Driving and other Locomotive Wheels, Axles Springs and Flange Tires; Car Wheels of cast iron, from a variety of patterns, and Chills; Car Wheels of cast iron, with wrought Tires; Axles of best American refined iron; Springs; Boxes and Bolts for Cars.

COTTON, WOOL, & FLAX MACHINERY,

Of all descriptions and of the most improved patterns, Style, and Workmanship.

Mill Geering and Millwright work generally; Hydraulic and other Presses; Press Screws; Calenders; Lathes and Tools of all kinds; Iron and Brass Castings of all descriptions.

ROGERS, KETCHUM & GROSVENOR,
Paterson, N. J. or 60 Wall-st. New-York
51tf

FRAME BRIDGES.

THE undersigned, General Agent of Col. S. H. LONG, to build Bridges, or vend the right to others to build on his Patent Plan, would respectfully inform Railroad and Bridge Corporations, that he is prepared to make cohtracts to build, and furnish all materials for superstructures of the kind, in any part of the United States, (Maryland excepted.)

Bridges on the above plan are to be seen at the following localities, viz. On the main road leading from Baltimore to Washington; two miles from the former place. Across the Motawamkeag river on the Military road in Maine. On the national road in Illinois, at sundry points. On the Baltimore and Susquehanna Railroad at three points. On the Hudson and Paterson Railroad in two places. On the Boston and Worcester Railroad, at several points. On the Boston and Providence Railroad, at sundry points. Across the Contoocook river at Hennikar, N. H. Across the Souhegan river, at Milford, N. H. Across the Connecticut river, at Hancock, N. H. Across the Androscoggin river, at Turner Centre, Maine. Across the Kennebec river, at Waterville, Maine. Across the Genesee river, at Squakichill, Mount Morris, N. Y. Across the White River, at Hartford, Vt. Across the Connecticut River at Lebanon, N. H. Across the mouth of the Broken Straw Creek, Penn. Across the mouth of the Cataraugus Creek, N. Y. A Railroad Bridge diagonally across the Erie Canal, in the City of Rochester, N. Y. A Railroad Bridge at Upper Still Water, Orono, Maine. This Bridge is 500 feet in length; one of the spans is over 200 feet. It is probably the *firmest wooden bridge* ever built in America.

Notwithstanding his presect engagements to build between twenty and thirty Railroad Bridges, and several common bridges, several of which are now in progress of construction, the subscriber will promptly attend to business of the kind to much greater extent and on liberal terms.

MOSES LONG.
Rochester, Jan. 19th, 1837. 4—y

STEPHENSON,

Builder of a superior style of Passenger Cars for Railroads,

No. 264 Elizabeth street, near Bleecker street,

NEW-YORK.

RAILROAD COMPANIES would do well to examine these Cars; a specimen of which may be seen on the New-York and Harlaem Railroad, now in operation.

ROACH & WARNER,

Manufacturers of OPTICAL, MATHEMATICAL AND PHILOSOPHICAL INSTRUMENTS, 293 Broadway, New-York, will keep constantly on hand a large and general assortment of Instruments in their line.

Wholesale Dealers and Country Merchants supplied with SURVEYING COMPASSES, BAROMETERS, THERMOMETERS, &c. &c. of their own manufacture, warranted accurate, and at lower prices than can be had at any other establishment.

☞ Istruments made to order and repaired.
1y—14

RAILWAY IRON, LOCOMOTIVES, &c. &c.

THE subscribers offer the following articles for sale:—

Railway Iron, flat bars; with countersunk ho'es and mitred joints,

350 tons	2 by	, 15 ft in length, weighing				4 $\frac{66}{100}$	lbs per
280	" 2	" $\frac{1}{2}$,	"	"	"	3 $\frac{56}{100}$	"
70	" 1½	" $\frac{1}{2}$,	"	"	"	2½	"
80	" 1½	" $\frac{1}{4}$,	"	"	"	1 $\frac{25}{100}$	"
90	" 1	" $\frac{1}{4}$,	"	"	"	$\frac{7}{8}$	"

witn Spikes and Splicing Plates adapted thereto To be sold free of duty to State governments, or incorporated companies.

Orders for Pennsylvania Boiler Iron executed.

Rail Road Car and Locomotive Engine Tires, wrought and turned or unturned, ready to be fitted on the wheels, viz. 30, 33, 36, 42, 44, 54, and 60 inches diameter.

E. V. Patent Chain Cable Bolts for Railway Car axles, in lengths of 12 feet 6 inches, to 13 feet 2½, 2⅔, 3, 3⅓, 3¼, 3½, and 3¾ inches diameter.

Chains for Inclined Planes, short and stay links, manufactured from the E. V. Cable Bolts, and proved at the greatest strain.

India Rubber Rope for Inclined Planes, made from New Zealand Wax.

Also, Patent Hemp Cordage for Inclined Planes, and Canal Towing Lines.

Patent Felt for placing between the iron chair and stone block of Edge Railways.

Every description of Railway Iron, as well as Locomotive Engines, imported at the shortest notice, by the agency of one of our partners, who resides in England for this purpose.

A highly respectable American Engineer resides in England for the purpose of inspecting all Locomotives, Machinery, Railway Iron, &c. ordered through us.

A. & G. RALSTEN & CO.,
28 tf Philadelphia, No. 4 South Front-st.

ARCHIMEDES WORKS.

(100 North Moore-street, N.Y.)

THE undersigned beg leave to inform the proprietors of Rail Roads, that they are prepared to furnish all kinds of Machinery for Rail Roads, Locomotive Engines of any size, Car Wheels, such as are now in successful operation on the Camden and Amboy Rail Road, none of which have failed.—Castings of all kinds, Wheels, Axles and Boxes, furnished at the shortest notice.

H. R. DUNHAM & CO.
NEW YORK, February 12th, 1836. 4—ytf

PATENT RAILROAD, SHIP AND BOAT SPIKES.

*** The Troy Iron and Nail Factory keeps constantly for sale a very extensive assortment of Wrought Spikes and Nails, from 3 to 10 inches, manufactured by the subscriber's Patent Machinery, which after five years successful operation, and now almost universal use in the United States, (as well as England, where the subscriber obtained a patent) are found superior to any yet ever offered in market.

Railroad companies may be supplied with Spikes having countersink heads suitable to the holes in iron rails, to any amount and on short notice. Almost all the Railroads now in progress in the United States are fastened with Spikes made at the above-named factory—for which purpose they are found invaluable, as their adhesion is more than double any common Spikes made by the hammer.

*** All orders directed to the Agent, Troy, N.Y. will be punctually attended to.

HENRY BURDEN, Agent.
Troy, N.Y., July, 1831.

*** Spikes are kept for sale, at factory prices, by I & J. Townsend, Albany, and the principal Iron Merchants in Albany and Troy; J. I. Brower, 222 Water-street, New-York; A. M. Jones, Philadelphia; T. Janviers, Baltimore; Degrand & Smith, Boston.

P. S.—Railroad companies would do well to forward their orders as early as practicable, as the subscriber is desirous of extending the manufacturing so as to keep pace with the daily increasing demand for his Spikes.

1J23am H. BURDEN.

G. Mitchell, Printer, 265 Bowery, N.Y